

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (ADVANCE MANUFACTURING SYSTEM) (50)

MICRO AND NANO MANUFACTURING SYSTEM

SUBJECT CODE: 2735003

M.E. 3rd SEMESTER

Type of course: Engineering Science

Prerequisite: Fundamental understanding in Materials, Product Design, Manufacturing processes etc.

Rationale: Subject is designed to understand the principles of various micro and nano manufacturing methods. This subject aims for the student to acquire knowledge of the fundamentals of micro and nano-products and of the manufacturing of such products and knowledge of micro and nano-materials processing methods and techniques.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Contents	Total Hrs.	% Weightage
1	Scope of Nano Technology: Nano technology Concepts and Applications, Micro- and Nanofabrication, Nano technology in India, Scope for Micro-fabrication, Rise Nano technology Fields, Commercialization Issues of Micro-Nano Technology	4	10%
2	Micro-fabrication: Mechanical Micromachining, Physical Fabrication Methods, Lithography, Processing Setup, Nano Lithography & Manipulation, Precision Micro- and Nano grinding , Use of Spectrometers & Microscopes	10	25%
3	Laser-Based Micro and Nanofabrication, Pulsed Water Drop Micromachining, Nano Materials, Synthesis of Nano materials, Bio Materials, Nano Composites, Development of Nano Particles	10	25%
4	Innovative Applications on Present Devices: Nano chips, Nanotubes and Nanowires, Integration of chips and microprocessors, Technology Support, Meeting Social Needs	8	20%
5	Nano Design & CAD: Computer Aided Nano Design, VLSI product detailing Finite Element Analysis of Microstructures, 3-D Molecular Modelling	10	20%

References:

1. Micro fabrication & Nano manufacturing by Mark J. Jackson
2. ASM handbook on machining

3. Springer's Hand book of Nano-technology - Bharat Bhusan (Ed.)
4. Nanotechnology and Nano electronics – WR Fahrner, Springer International Z. Cui, Nanofabrication, Springer, 2008
5. Gabor L. Hornyak, H.F. Tibbals, Joydeep Dutta, and John J. Moore, Introduction to Nano science and Nanotechnology, CRC Press, Boca Raton, 2009.

Course Outcome:

At the end of this course the student will be able to apply the knowledge in mechanics, scaling, design, fabrication and characterization of Micro and Nano systems.

List of Experiments:

1. Design, Simulation and analysis of Nano structures using software like “cadnano”.
2. Experiments should be conducted as per the laboratory facilities available at the Institute.
3. Students can also take up projects on design and development Micro machining set up as a part of laboratory work.

Design based Problems (DP)/Open Ended Problem:

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.